1,017,564

PATENT SPECIFICATION

DRAWINGS ATTACHED

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Int. Cl.:—F 02 f // F 04 c

COMPLETE SPECIFICATION

Improvements in or relating to Piston-Type Compressors

I, MADS CLAUSEN, trading as HIRMA DANFOSS, VED. ING. M. CLAUSEN, a Danish Subject of Nordborg, Denmark, do hereby declare the invention, for which I pray that a patent may be granted to me, and the method by which it is to be performed, to be particularly described in and by the following statement:—

This invention relates to piston-type compressors particularly, though not exclusively, as used in small refrigerating machines.

In compressors for refrigerating machines, which are usually mounted within an hermetically sealed capsule, it is convenient to cast the cylinder block in a form having integral silencing chambers disposed on each side of the cylinder. The chambers on one side usually act as a suction muffler or silencer and the chambers on the other side of the cylinder act as a pressure muffler or silencer.

In mass produced compressors this design of the cylinder block tends to be disadvantageous when different sizes or types of compressors are to be manufactured. If one form of cylinder block is used with silencing chambers functioning as described then a change of diameter of the cylinder or a change in the length of stroke of the piston or the stroke rate or even the specific gravity of the fluid being compressed results in the silencing chambers being less effective. This is because each size or type of compressor requires a particular silencing system.

It is an object of this invention to produce from identical cylinder block castings a range of piston-type compressors.

According to the present invention a method of producing from identical cylinder block castings having at least two integral silencing chambers a range of piston-type compressors, each member of the range having different size cylinder bores and therefore different silencing characteristics, includes the steps of providing an appropriate valve plate having suction and pressure valves for each member of the range, the valve plate being situated between tht cylinder block and an angularly adjustable cylinder head formed with a partition producing on assembly to the cylinder block suction and pressure valve chambers, forming the cylinder block with bores so arranged that by appropriate orientation of the cylinder head and positioning of its appropriate valve plate, communication is afforded between one silencing chamber and the suction valve chamber and another silencing chamber and the pressure valve chamber for one member of the range, between the same two silencing chambers connected in parallel to the suction valve chamber in a second member of the range, and between at least two silencing chambers in series and the suction valve chamber for a third member of the range.

The silencing chambers can all be connected in series or a series-parallel combination can be formed for example. In this way the silencing characteristics can be changed to suit different sizes or types of compressor in the said range while using the same casting for the cylinder block.

If two silencing chambers are provided then it is possible to connect them in series or in parallel in either the suction or the pressure side of the compressor in the said range. Thus several combinations are available, each of which will be suited to a different size or type of compressor. If the chambers are all used in the suction side of a compressor in the said range, then a separate pressure muffler is required in the pressure side but the expense of this is far less than that of having a separate casting for each size of compressor.

If more than two chambers are provided then the number of combinations is increased.

It is preferred to use the silencing chambers in the suction side of a compressor in the said range due to the thermal conditions.

It is possible to adapt the silencing system to suit different sizes or types of compressor

in the said range by directly connecting two series connected chambers to the suction valve chamber by a channel. It is also possible to vary the silencing effect by having an inlet and/or outlet of a chamber formed by a boring in the cylinder block into which boring is inserted a tube of predetermined cross-sectional area and length to suit the requirements of a particular compressor in the said range.

When connecting two or more chambers in series, usually it is necessary to employ an additional connecting pipe, tube or boring. However, when connecting in parallel it is possible to avoid the use of these additional items by arranging for one junction of the parallel connection to lie within one of the valve chambers of a compressor in the said range This may be achieved by connecting appropriate chambers to the cylinder head by borings for example, and so disposing the cylinder head that the borings terminate in one and the same valve chamber. The cylinder head is formed with an intermediate partition, thus forming two valve chambers, for the suction and pressure valves, and it is adjustably mounted enabling it to be orientated. In one position the said borings will terminate in the one and the same valve chamber and in another position the borings will terminate one in each valve chamber. Thus re-orientation of the cylinder head, possibly involving a change in the pressure line inlet, enables the silencing characteristics to be altered to suit one particular size or type of compressor in the said range. The method of the invention will now be described in more detail by way of example with reference to the accompanying drawings of which:—

Fig. 1 shows a diagrammatic sectional plan of a cylinder block of a known type of compressor but having an angularly adjustable cylinder head.

Figs. 2 and 3 each show a diagrammatic sectional plan of a cylinder block embodying the invention.

Fig. 4 shows an end view of fig. 2 with parts removed, the line A—A being the section line of fig. 2.

Referring to Figures 1—3 in general, a cylinder block 1 has a cylinder bore 2 and integral silencing chambers 3 and 4 on one side of the cylinder 2 and integral silencing chambers 5 and 6 on the opposite side. The end 7 of the block 1 is covered by a valve plate 8 which in turn has a cover 11.

Referring now to Figure 1 in particular, the chambers 3 and 4 are suction silencing chambers and the chambers 5 and 6 are pressure silencing chambers. The chambers 3 and 4 are series connected by a boring 16 and chamber 3 has a suction inlet port 15. The chambers 5 and 6 are series connected by a boring 19 and chamber 6 has a pressure outlet port 20.

The cylinder head 11 is divided by a partition 14 to form a suction valve chamber 12 which connects with suction chamber 4 through a boring 17, and a pressure valve chamber 13 which connects with pressure chamber 5 through a boring 18. The valve plate 7 houses a suction valve 9 and a pressure valve 10. The mounting means of the cylinder head 11 permits it to be mounted either in the position of Fig. 1 or in an alternative position formed through 90° as shown in Fig. 2.

In operation, gaseous refrigerant is drawn into the cylinder 2 via the suction inlet port 15, suction chamber 3, boring 16, suction chamber 4, boring 17, suction chamber 12 and finally suction valve 9. The refrigerant is then compressed in the cylinder by a piston (not shown) and flows to the pressure line of the compressor via pressure valve 10, pressure chamber 13, boring 18, pressure chamber 5, boring 19, pressure chamber 6 and the pressure outlet port 20 to which the pressure line (not shown) is connected. Thus silencing of the compressor is achieved on both the suction and pressure sides by four chambers, two disposed on each side of the cylinder 2, the silencing chambers being integrally formed with the cylinder block, as is known.

Referring now to figure 2, the cylinder block 1 is produced from the same mould or casting as that of figure 1 but the cylinder 2 is drilled out so that it has a greater diameter thereby giving the compressor a larger stroke. The silencing chambers 3 and 4 are again connected in series by the boring 16 but are connected in parallel with the chambers 5 and 6 which are again in series connected by the boring 19. The two pairs of chambers are connected in parallel in the following manner. The ports 15 and 20 are both made suction ports and the adjustably mounted cylinder head 11 is mounted so that its partition 14 is turned through 90° compared with its position in fig. 1, whereby the suction valve chamber 12 is common to both the borings 17 and 18. Thus the gaseous refrigerant is drawn into the cylinder through the suction valve 9 from two parallel routes consisting of the items 15, 3, 16, 4 and 17, and the items 20, 6, 19, 5 and 18. In the modified valve plate of fig. 2 the valve 9 with the valve 10, not seen in fig. 2, in this case is on a line at right angles to the valves 7 and 10 in fig 1. The compressed refrigerant is taken to the pressure line 21 which is directly connected to the pressure valve chamber 13, not shown in figure 2, the chamber 13 containing the valve 10 in this case.

From figure 4 it will be seen that the borings 17 and 18 in figures 1 and 2 terminate at points not lying on a common diameter of the cylinder 2 thereby making it possible for the cylinder head 11 to be orientated as described above so as either to have the parti-

tion 14 separating the borings along the line B—B as in figure 1, or making the borings 18 and 17 common to either one of the valve chambers 12 and 13 (partition along the line C—C).

In the embodiment of figure 2 all the silencing chambers are used in connection with the suction side of the compressor and it is therefore desirable to include a pressure muffler (not shown) in the pressure line 21 to silence the pressure side of the compressor.

Referring now to Figure 3 which illustrates another cylinder block of a compressor in the said range having the same valve plate 8 and angularly adjustable cylinder head 11 as in Fig. 1, the cylinder block 1 is again produced from the same mould or casting as that of Figure 1, the cylinder 2 being drilled out to give it a diameter greater than that of the cylinder of Figure 1 but less than that of Figure 2. Therefore the silencing requirements are different and in this case all the silencing chambers 3—6 are connected in series on the suction side of the compressor. The boring 18 is replaced by a suction inlet port 22 connecting with chamber 5 and the ports 15 and 20 are interconnected by a pipe 23. Thus gaseous refrigerant is drawn into the cylinder 2 via the items 22, 5, 19, 6, 20, 23, 15, 3, 16, 4, 17, 12 and finally the suction valve 9. After being compressed, the refrigerant is taken to the pressure line 21 through the pressure valve 10 and again the pressure line has a pressure muffler (not shown).

The silencing effect may be improved by insertion of a tube 24, shown in broken lines whose length and cross-section is matched to the noise frequency to be damped. Such a matched tube may be inserted as shown in fig. 3 but it might also be inserted in the boring 16 or alternatively both the borings 16 and 19 could be provided with matched tubes. An additional boring 25, also shown in broken lines, will also improve the silencing effect. The boring 22 leads from the inside of the capsule to the silencing chamber 5, which is connected in series with the chambers 6 and 3. Therefore, since the boring 25 leads from the inside of the capsule to the silencing chamber 3 it acts as a short-circuit boring between the inlet boring 22 and chamber 3. The cross-section of boring 25 is only a fraction of the cross-section of boring 22 but as part of the suction gas is sucked in through the boring 25 the silencing effect will be improved.

It will be seen that a range of compressors made in accordance with the invention utilises a set casting for the cylinder block which may be adapted to suit different sizes and types of compressor.

WHAT I CLAIM IS:—

1. A method of producing from identical cylinder block castings having at least two integral silencing chambers a range of piston type compressors, each member of the range having different size cylinder bores and therefore different silencing characteristics, the method including the steps of providing an appropriate valve plate having suction and pressure valves for each member of the range, the valve plate being situated between its cylinder block and an angularly adjustable cylinder head formed with a partition producing on assembly to the cylinder block suction and pressure valve chambers, forming the cylinder block with bores so arranged that by appropriate orientation of the cylinder head and positioning of its appropriate valve plate, communication is afforded between one silencing chamber and the suction valve chamber and another silencing chamber and the pressure valve chamber for one member of the range, between the same two silencing chambers connected in parallel to the suction valve chamber in a second member of the range, and between at least two silencing chambers in series and the suction valve chamber for a third member of the range.

2. A range of piston type compressors as produced by the method of claim 1 in which the chambers are interconnected by means of tubes and/or borings.

3. A range of compressors as claimed in claim 2 in which a particular member of the range includes two pairs of chambers the chambers of each pair being connected in series.

4. A range of compressors as claimed in claim 3, the said member of the range having one pair of the chambers associated with the suction side of the compressor and the other pair associated with the pressure side of the compressor.

5. A range of compressors as claimed in claim 3 wherein the two pairs of chambers of the said member are series connected through a tube and are both associated with the suction path of the compressor.

6. A range of compressors as claimed in claim 3 wherein the two pairs of chambers of the said member are parallel connected and are both associated with the suction path of the compressor.

7. A method of producing a range of piston-type compressors substantially as hereinbefore described.

ABEL & IMRAY,
Quality House, Quality Court,
Chancery Lane, London, W.C.2.

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Fig. 1

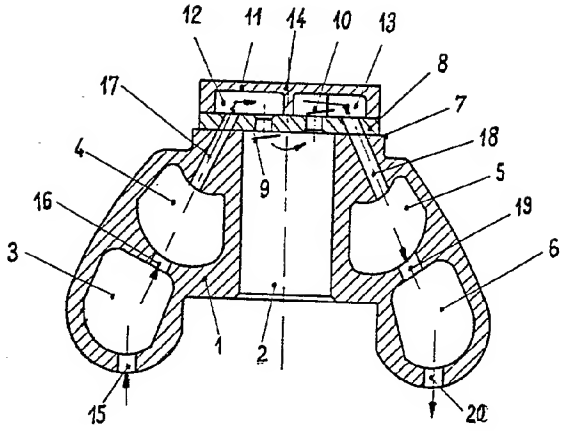
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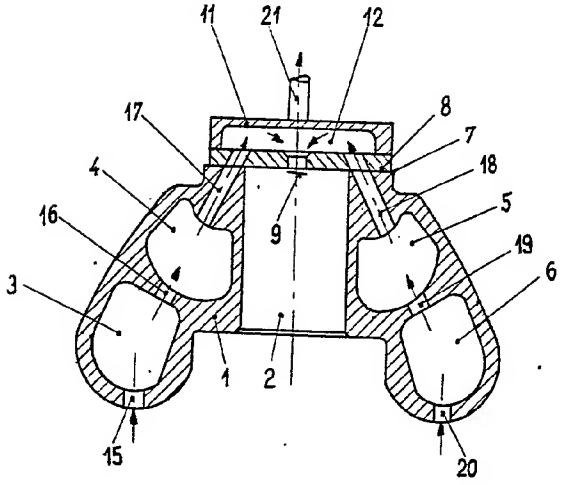
Fig. 2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1017564 COMPLETE SPECIFICATION
2 SHEETS *This drawing is a reproduction of the Original on a reduced scale*
Sheets 1 & 2

Fig. 3

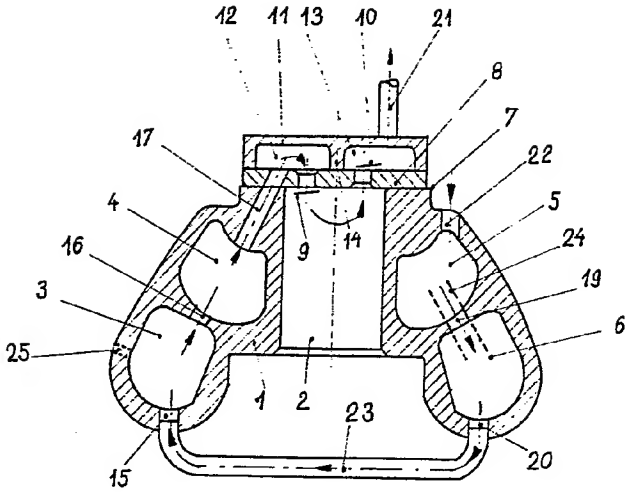
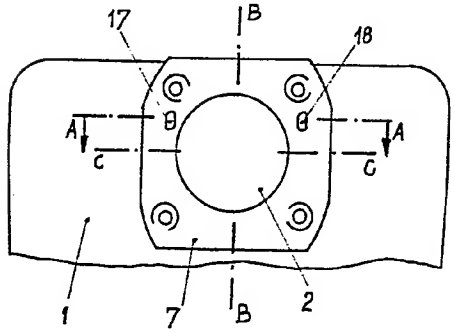


Fig. 4



1017564 COMPLETE SPECIFICATION
2 SHEETS This drawing is a reproduction of the Original on a reduced scale
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Fig. 1

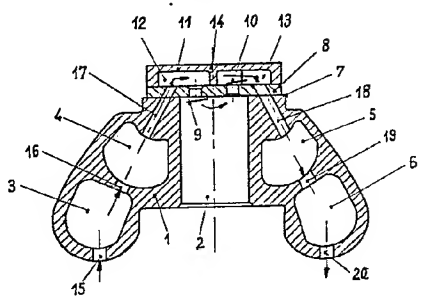

Fig. 2

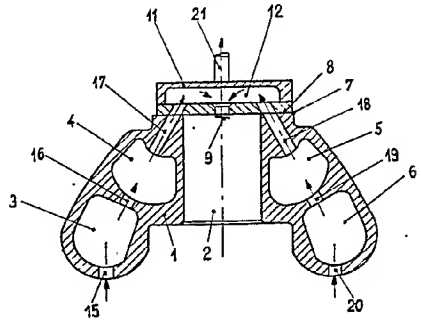

Fig. 3

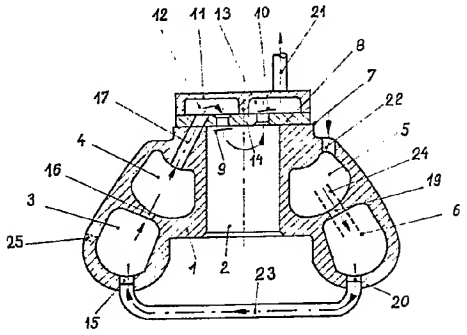

Fig. 4